WHAT IS CLAIMED:

1. A dielectric thin film prepared by polymerizing an ethylenic-containing precursor with a benzocyclobutane-containing precursor.

2. The dielectric thin film of claim 1, wherein the ethylenic-containing precursor has a general structure of:

$$P\text{-}(\text{-}Z\text{-}W)_{n^o} \qquad \text{(Ia);}$$

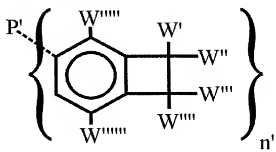
wherein, W is hydrogen, fluorine or a fluorinated phenyl;

P is an aromatic-moiety with a general structure of $-C_6H_{4-n}F_n-$ (n = 0 to 4); $-C_6H_{4-n}F_n\text{–}CF_2\text{-}C_6H_{4-n}F_n-$ (n = 0 to 8); $-C_{10}H_{6-n}F_n-$ (n = 0 to 6), or $-C_{12}H_{8-n}F_n-$ (n = 0 to 8);

Z is a moiety having an ethylenic group; and

n^o is an integer of at least 2, but is less than total sp^2C substitutions on the P aromatic-moiety;

3. The dielectric thin film of claim 1, wherein the benzocyclobutane containing precursor has a general structure of:



(IIa')

wherein, W is hydrogen, fluorine or a fluorinated phenyl;

P' is an aromatic-moiety with a general structure of $-C_6H_{4-n}F_n-$ (n = 0 to 4); $-C_6H_{4-n}F_n\text{–}CF_2\text{-}C_6H_{4-n}F_n-$ (n = 0 to 8); $-C_{10}H_{6-n}F_n-$ (n = 0 to 6), or $-C_{12}H_{8-n}F_n-$ (n = 0 to 8); and

n' is an integer of at least 2, but is less than total sp^2C substitutions on the P' aromatic-moiety;

4. The dielectric thin film of claim 1, wherein the dielectric thin film has a dielectric constant ("ε") value equal to or less than 2.6.

5. The dielectric thin film of claim 1, wherein one or more layers of the thin film is deposited inside an integrated circuit ("IC") or an electronic device.

6. The dielectric thin film of claim 5, wherein the electronic device comprises an active matrix liquid crystal display, or a fiber optic device.

7. The dielectric thin film of claim 5, wherein the IC is manufactured via a dual damascene process comprising the dielectric thin film.

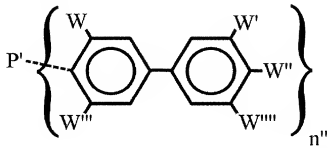
8. A dielectric thin film prepared by polymerizing an ethylenic-containing precursor with a biphenyl-containing precursor.

9. The dielectric thin film of claim 8, wherein the ethylenic-containing precursor has a general structure of:

$$P\text{-}(\text{-}Z\text{-}W)_{n^o} \qquad \text{(Ia);}$$

wherein, W is hydrogen, fluorine or a fluorinated phenyl;
P is an aromatic-moiety with a general structure of $-C_6H_{4-n}F_n$ -(n = 0 to 4); $-C_6H_{4-n}F_n-CF_2-C_6H_{4-n}F_n$ – (n = 0 to 8); $-C_{10}H_{6-n}F_n$- (n = 0 to 6), or $-C_{12}H_{8-n}F_n$ - (n = 0 to 8);
Z is a moiety having an ethylenic group; and
n^o is an integer of at least 2, but is less than total sp^2C substitutions on the P aromatic-moiety;

10. The dielectric thin film of claim 8, wherein the biphenyl containing precursor has a general structure of:



(IIb')

wherein, W is hydrogen, fluorine or a fluorinated phenyl;

P' is an aromatic-moiety with a general structure of $-C_6H_{4-n}F_n$ -(n = 0 to 4); $-C_6H_{4-n}F_n-CF_2-C_6H_{4-n}F_n$ – (n = 0 to 8); $-C_{10}H_{6-n}F_n$- (n = 0 to 6), or $-C_{12}H_{8-n}F_n$ - (n = 0 to 8); and

n'' is an integer of at least 2, but is less than total sp^2C substitutions on the P' aromatic-moiety;

11. The dielectric thin film of claim 8, wherein the dielectric thin film has a dielectric constant (ε) value equal to or less than 2.6.

12. The dielectric thin film of claim 8, wherein one or more layers of the thin film is deposited on an integrated circuit ("IC") or an electronic device.

13. The dielectric thin film of claim 12, wherein the electronic device comprises an active matrix liquid crystal display, or a fiber optic device.

14. The dielectric thin film of claim 12, wherein the IC is manufactured via a dual damascene process comprising the dielectric thin film.

15. A dielectric thin film prepared by polymerizing an ethylenic-containing precursor with a dieneone-containing precursor.

16. The dielectric thin film of claim 15, wherein the ethylenic-containing precursor has a general structure of:

$$\text{P-(-Z-W)}_{n^{o}} \qquad \text{(Ia);}$$

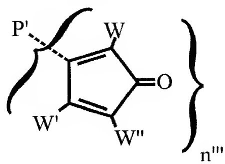
wherein, W is hydrogen, fluorine or a fluorinated phenyl;

P is an aromatic-moiety with a general structure of $-C_6H_{4-n}F_n$ -(n = 0 to 4); $-C_6H_{4-n}F_n-CF_2-C_6H_{4-n}F_n$ – (n = 0 to 8); $-C_{10}H_{6-n}F_n$- (n = 0 to 6), or $-C_{12}H_{8-n}F_n$ - (n = 0 to 8);

Z is a moiety having an ethylenic group; and

n^o is an integer of at least 2, but is less than total sp^2C substitutions on the P aromatic-moiety;

17. The dielectric thin film of claim 15, wherein the dieneone-containing precursor has a general structure of:



(IIc')

wherein, W is hydrogen, fluorine or a fluorinated phenyl;

P' is an aromatic-moiety with a general structure of $-C_6H_{4-n}F_n$ -(n = 0 to 4); $-C_6H_{4-n}F_n-CF_2-C_6H_{4-n}F_n$ – (n = 0 to 8); $-C_{10}H_{6-n}F_n$- (n = 0 to 6), or $-C_{12}H_{8-n}F_n$ - (n = 0 to 8); and

n''' is an integer of at least 2, but is less than total sp^2C substitutions on the P' aromatic-moiety;

18. The dielectric thin film of claim 15, wherein the dielectric thin film has a dielectric constant (ε) value equal to or less than 2.6.

19. The dielectric thin film of claim 15, wherein one or more layers of the thin film is deposited on an integrated circuit ("IC") or an electronic device.

20. The dielectric thin film of claim 19, wherein the electronic device comprises an active matrix liquid crystal display or a fiber optic device.

21. The dielectric thin film of claim 19, wherein the IC is manufactured via a dual damascene process comprising the dielectric thin film.

22. A method of making a dielectric thin film material, comprising:

(a) dissolving or suspending the precursors in a solvent to give a solution or suspension of the precursor in the solvent;

(b) spinning the solution or the suspension of the precursors in the solvent onto a substrate to form a thin wet film;

(c) heating the thin wet film to a temperature that is below a boiling-temperature of the solvent to remove most of the solvent from the thin wet film to form a thin dried film; and

(d) heating the thin dried film to a temperature that is below a glass-transition temperature of the thin dried film to give the dielectric thin film material

23. The method of claim 22 wherein, a rate of heating the wet film occurs at 3 to 5°C per minute to a maximum temperature that is below the boiling-temperature of the solvent.

24. The method of claim 23 wherein, the wet thin film is heated to a maximum temperature that ranges from 5 to 50°C below the boiling-temperature of the solvent.

25. The method of claim 22 wherein, a rate of heating the thin dried film occurs at 10°C per minute to a maximum temperature that is below the glass-transition temperature of the thin dried film.

26. The method of claim 25 wherein, the thin dried film is heated to a maximum temperature that ranges from 10 to 20°C below the glass-transition temperature of the thin dried film.